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LIFE-HISTORIES OF INDIAN INSECTS MICROLEPIDOPTERA

VI. GRACILLARIADÆ

BY

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Lithocolletis triarcha:—Moth, natural size and magnified. Below is seen a side-view of the head, considerably magnified.

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(Received for publication on 27th June 1919.)

LITHOCOLLETIS TRIARCHA, MEYR. (PLATE XXXIII.)

Lithocolletis triarcha, Meyr., B. J., XVIII, 811 (1908)(1); Lefroy, Ind. Ins. Life, p. 537 (1909)(2).

Described from Pusa, where it was reared from larvæ mining leaves of cotton(1). Lefroy(2) gives the foodplant as tree-cotton, but most varieties of cotton may be attacked.

Larva flattened, but all * legs present; mines lower surface of leaf; pupation in mine(2).

This species is common at Pusa on cotton, especially on American varieties, and is probably widely distributed in the Plains, although not yet noted elsewhere. The larva mines the lower surface of the leaf which turns yellowish white with brown spots. The larva is about 4 mm. long, segments distinct, tapering posteriorly; head small, pointed anteriorly, greenish or yellow; prothorax broad with two brownish spots separated by a greenish band; other segments yellow with a pinkish or greenish tinge, skin rather transparent especially on sixth to eighth abdominal segments; anal shield green, shiny; primary hairs short; legs short; yellow or green; prolegs on third to fifth

* This statement is incorrect and based on an erroneous statement in A. Mujtaba's Cage-slip 9.

abdominal segments, together with the anal claspers. Pupation takes place inside the mine, in a white silken cocoon. Pupa about 2·5 mm. long, brown. A large proportion of the larvæ are parasitized. (Umrao Bahadur's Cage-slip 20.)

LITHOCOLLETIS VIRGULATA, MEYR. (PLATE XXXIV.)

Lithocolletis virgulata, Meyr., B. J., XXIII, 118-119 (1914)(1), Exot. Micr., II, 5-6 (1916)(2).

Originally described from Karwar, where it was bred from cocoons found on *Ficus*(1).

Reared at Pusa from "larvæ mining blotches on upper surface of leaves of *Butea frondosa*, pupating within the mine. This is normal for the genus and is doubtless correct, but does not accord with Mr. Maxwell's account of the original specimens, bred from cocoons 'unusually large for the size of the moth' found exposed on leaves of a tree at first stated to be a *Ficus* but this identification was subsequently withdrawn; it seems likely that there must have been some error here, and that the moths did not really emerge from these cocoons".

Mined leaves of *Butea frondosa*, containing larvæ and pupæ, were found at Pusa on 22nd February 1916 and 11th March 1916. The mines are situated on the upper surface of the leaf. Pupation takes place within the mine in a thin cocoon woven beneath the epidermis of the leaf. A large proportion of the larvæ are parasitized by a small Hymenopteron, of which four to six grubs are found in each larva, these grubs pupating inside the body of the host which becomes twisted up like a rope (figure 2). (C. S. Misra's Cage-slip, dated 22nd February 1916.)

LITHOCOLLETIS CONISTA, MEYR. (PLATE XXXV, FIG. 1.)

Lithocolletis conista, Meyr., E. M. M., XLVII, 212-213 (Sept. 1911)(1), Wytsm. Gen. Ins. fasc., 128, p. 8, tab., f. 11 (1912)(2), Exot. Micr., I, 622 (1916) [description amended](3).

Described from Pusa, where it was reared from larvæ mining leaves of *Triumfetta neglecta* (Tiliaceæ)(1).

Larvæ were found at Pusa on 3rd June 1910 mining under the epidermis of the under surfaces of leaves of *Triumfetta neglecta*. Many larvæ feed in one leaf, each mining an area of about one-seventh to one-fifth of a square inch. The mines are of an irregular shape, usually bounded by the larger leaf-veins, as the larvæ never cross such veins. The larvæ eat very little of the mesophyll substance and a newly-attacked leaf is hardly distinguishable

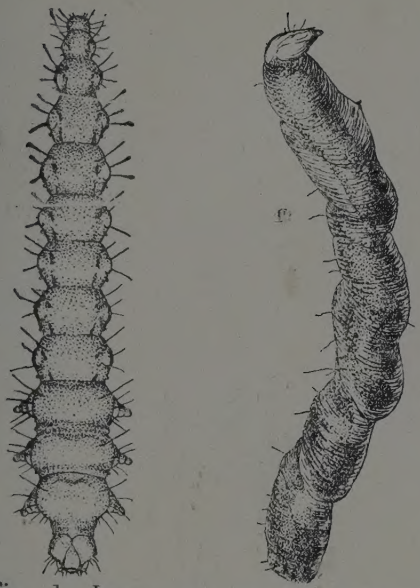


Fig. 1. Larva and parasitized larva (X 16).

Fig. 2. Mined leaf of *Butea frondosa* with empty pupa-cases protruding.

Fig. 3. *a*, Pupa, natural size and magnified (x 20) ; *b*, moth, natural size and magnified (x 26) ; *c*, side-view of head of moth, highly magnified.
LITHOCOLLETIS VIRGULATA.

Fig. 1. *Lithocolletis conista*:—*a*, Leaf of *Triumfetta neglecta*, mined by larvæ; *b*, arrangement of setigerous tubercles on larval segments ; *c*, a single hair, more highly magnified ; *d*, moth, natural size and magnified (x 12).

Fig. 2. *Epicephala chalybacma*:—Moth, resting posture.

from above, but when the larvæ pupate it is easily distinguished on account of its crumpled appearance.

When full-grown the larva is about 3·5 mm. long, slightly flattened and slightly tapering posteriorly, segments distinct, thoracic much broader than abdominal segments; head pale yellow tinged with brownish, much smaller than prothorax, flattened, tapering anteriorly; general colour very pale yellow, the green contents of alimentary canal showing through the transparent skin, prolegs only on third to fifth abdominal segments together with the ana claspers; hairs on segments long and thickened a little above the base, there being four such hairs on each segment. Before pupation the colour changes to orange-yellow.

The larva pupates inside its mine. First the two opposite edges of the mine are drawn closer by means of silken threads passed across; then a white silken cocoon is formed by lining this cavity with silk. The leaf becomes crumpled on account of the edges of all the mines being drawn together in this way.

The pupa is about 3 mm. long from head to anal extremity, cylindrical, tapering posteriorly, yellow; head prolonged into a pointed process, as is also the dorsal portion of the anal extremity; long hairs, bent posteriorly scattered on the segments; sixth abdominal segment ventrally with a paired lateral stiff blunt process on its posterior portion.

Before emergence of the moth, the pupa wriggles out at one end of the cocoon for more than half its length, its ventral surface held away from the surface of the leaf. (Insectary Cage-slip 838.)

LITHOCOLLETIS ITEINA, MEYR.

Lithocolletis iteina, Meyr., Exot. Micr., II, 173 (1918)[1].

"Bred at Pusa in March from larvæ mining blotches on underside of leaves of *Salix*"[1].

This species was reared at Pusa from larvæ found mining leaves of *Salix* sp. on 27th February 1916. The larva mines beneath the epidermis on the under surface of the leaf, there being usually only one larva in the same leaf. The epidermal layer, under which the larva works, becomes detached from the leaf tissue and contracts to a certain extent longitudinally, so as to form a sort of rib. The internal tissue of the leaf is not much eaten; hence the mine is hardly visible from the upper surface in most cases. In some cases, however, portions of the mesophyll tissue are nibbled and some scattered yellow spots appear on the upper surface. The larva is about 3 mm. long and 0·5 mm. broad across midbody, cylindrical, tapering posteriorly, segments

distinct, transparent whitish, fourth to eighth abdominal segments tinged with yellow; head much smaller than prothorax, shiny, pale brownish, mouth-parts brown; tubercles on body bearing long pale whitish hairs; second to eighth abdominal segments with a large black hemispherical dorsal spot; prolegs only on third to fifth abdominal segments, together with the anal claspers.

Pupation takes place inside the mine. The pupa is dirty brown, about 4·5 mm. long and 0·75 mm. broad across the thoracic region, cylindrical, tapering posteriorly; head produced into a sort of short beak bent ventrally. Before emergence of the moth the pupa wriggles out of the mine to a certain extent and the empty pupa-case is left protruding from the mine. The moths emerged between 1st and 15th March and several Hymenopterous parasites were also bred. (Tahl Ram's Cage-slip 141.)

LITHOCOLLETIS CLARISONA, MEYR.

Lithocolletis clarisona, Meyr., Exot. Micr., I, 622 (1916)(1).

Bred at Peradeniya in July from mines in leaves of *Urena lobata* (Malvaceæ) (*Rutherford*)(1).

LITHOCOLLETIS BAUHINIÆ, STT.

Lithocolletis bauhiniæ, Stainton, T. E. S. (n.s.), III, 303-304 (1856)(1).

Described from Calcutta(1).

Larva mines the upper cuticle of the leaves of *Bauhinia purpurea* in irregular circular or oval patches, the leaf remaining uncontracted. Before changing to pupa, the larva spins a slight silken cocoon, drawing together the two cuticles of the leaf in the centre of the mined part, and forming almost an exact circle (*Atkinson*)(1).

LITHOCOLLETIS DORINDA, MEYR.

Lithocolletis dorinda, Meyr., Exot. Micr., I, 21 (1912)(1).

Described from Pusa, where it was reared from larvæ mining leaves of *Desmodium* (Leguminosæ)(1).

This species has been reared at Pusa from *Desmodium* leaves collected on 31st July 1907. The larva apparently mines the leaf although it does not seem to have been noted and our specimens were reared from pupæ found inside the mines, three pupæ being found in one mine. The pupa was described as 2 mm. long, tapering considerably posteriorly, yellowish-brown. (A. Mujtaba's Cage-slip 26.)

LITHOCOLLETIS GANODES, MEYR.

Lithocolletis ganodes, Meyr., Exot. Micr., II, 172 (1918)(1).

"Bred in October from larva mining leaf of *Pyrus malus* "(1) at Parachinar, Kurram Valley, N. W. F. Province.

LITHOCOLLETIS INCURVATA, MEYR.

Lithocolletis incurvata, Meyr., Exot. Micr., I, 622 (1916)(1).

" Bred at Karwar, North Kanara, in August from larvæ mining blotches in leaves of *Strobilanthes callosus* (Acanthaceæ) "(1).

LITHOCOLLETIS NEODOXA, MEYR.

Lithocolletis neodoxa, Meyr., Exot. Micr., I, 621 (1916)(1).

Bred at Pusa in August from larvæ mining in leaves of *Cajanus indicus*.

This has also been reared at Pusa from larvæ found mining leaves of *Rhynchosia* sp. (? *R. minima*) (Leguminosæ) on 31st August 1917. The mine commences as a yellowish-white patch at about the centre of the upper surface of the leaflet. By the time the larva is full-grown the mine extends over the whole of the upper surface and looks like a yellowish-white thin membranous covering. From the under surface in most cases hardly anything is perceptible but in a few cases, when the mesophyll tissue has been nibbled, faint spots are to be seen. The larva pupates inside the mine under cover of the membranous pellicle. A silken cocoon is formed and the two halves of the blade of the leaflet are partially drawn towards each other, the leaflet assuming the shape of a boat. The pupa wriggles out through one end of the cocoon and through the membranous pellicle before the moth bursts out of the pupa-case and the empty pupa-case remains partly protruding through the pellicle. Moths emerged between 3rd and 7th September. (Insectary Cage-slip 1668.)

PHRIXOSCELES PLEXIGRAPHA, MEYR.

Phrixosceles plexigrapha, Meyr., Exot. Micr., I, 623 (1916)(1).

" Reared at Pusa and Coimbatore from larvæ feeding in pods of *Cajanus indicus* "(1).

This species has been reared at Pusa from a larva found on 23rd March 1914, mining the surface of a green *arhar* (*Cajanus indicus*) pod on which broad zigzag whitish markings had been produced. When full-fed the larva emerged from the mine and pupated in a corner of the cage in a white membranous cocoon covered with a number of small globules such as are found on the cocoon of *Epicephala chalybacma*. Pupal period five days, the moth emerging on 8th April. (Insectary Cage-slip 1038.)

EPICEPHALA CHALYBACMA, MEYR. (PLATE XXXVI.)

Epicephala chalybacma, Meyr., B. J., XVIII, 811 (1908)(1), Exot. Micr., I 21-22 (1912)(2) ; Green, Pr. Ent. Soc., 1912, pp. cvii-cix, figs. (1913)(3).

Originally described from Peradeniya(1), this species has been recorded from Pusa(2) and also occurs at Calcutta, Nagpur, Serampore, Coimbatore and at Minbu in Lower Burma, and probably wherever *Cæsalpinia* (*Poinciana*) *pulcherrima* is grown in the Plains of India.

Larva without prolegs on 10, pale greenish-yellow ; head yellow ; when full-grown, with a red band on each of segments 2-12, a red spot on 13 ; feeds inside unexpanded flowers of *Poinciana pulcherrima* (Leguminosæ), showing no outward sign ; when full-grown, it gnaws its way out and pupates in a white cocoon covered with bubbles, usually on the upper surface of a leaf (*Fletcher*)(2).

Foodplants :—*Poinciana pulcherrima*(2), *Pithecolobium saman*(3).

" Larva small, but robust, measuring—when extended—about 6 mm. It is of a dull, pale, translucent green colour, with an irregular crimson band completely encircling each segment "(3).

The egg, which is small, whitish, elliptical in outline and somewhat flattened, is laid on the unopened flower-buds of the foodplant, which is usually *Cæsalpinia* (*Poinciana*) *pulcherrima*, a common ornamental shrub in Indian gardens, although this species has been found also on gold mohur (*Poinciana regia*) at Pusa and on the rain-tree (*Pithecolobium saman*) at Peradeniya. The proximal face of the egg is flattened and the distal end rounded, with several parallel longitudinal striæ. The larva, on hatching, bores into the bud and feeds mainly on the stamens and but rarely on the ovary. The entrance hole is too small to be noticed and also is probably closed by growth of the flower ; at any rate, no outward sign of damage is noticeable, although the bud may contain a full-grown larva and be filled with its reddish-brown pellets of excrement. The young larva is uniform pale greenish-yellow. When full-grown it is about 6 mm. long and 1·3 mm. broad across mid-body, tapering in both directions, body segments distinct, skin soft ; head yellow ; other segments pale green with a crimson band which is continued, although interrupted, around those segments which do not possess legs or prolegs ; anal segment with a dorsal crimson spot ; prolegs only on third to fifth abdominal segments, with the anal claspers.

When full-fed the larva gnaws its way out of the flower and usually drops by a silken thread on to the upper surface of a leaflet, where it forms a most curious cocoon, whose upper surface is ornamented with small bubbles. Occasionally this cocoon is formed on the lower surface of a leaflet. The

EXPLANATION OF PLATE XXVI.

PRODENIA CRASSIVENA.

Fig. 1. Shoot of *Crataegus Pyracantha*, showing a full-fed larva dropping by a thread from an attacked flower-bud and three cocoons on leaves (natural size).

" 2. Larva, natural size and magnified (1/3).

" 3. Pupa, natural size and magnified.

" 4. Cocoon, with empty pupa case, magnified.

" 5. Moth, resting position, natural size and magnified.

" 6. Moth, wings expanded, " " " "

EPICEPHALA CHALYBACMA, MEYR. (PLATE XXXVI.)

EXPLANATION OF PLATE XXXVI.

EPICEPHALA CHALYBACMA.

Fig. 1. Shoot of *Cæsalpinia pulcherrima*, showing a full-fed larva dropping by a thread from an attacked flower-bud and three cocoons on leaflets (natural sizes).

„ 2. Larva, natural size and magnified (× 13).

„ 3. Pupa, natural size and magnified.

„ 4. Cocoon, with empty pupa extruded, magnified.

„ 5. Moth, resting position, natural size and magnified.

„ 6. Moth, wings expanded, „ „ „

EPICEPHALA CHALYBACMA.

cocoon, which is pure white, measures about 5 to 6 mm. in length and about 2·5 to 3 mm. in breadth, but the ground-work is much larger and may extend over the entire surface of a leaflet. The larva first of all applies a layer of silk over the surface of the leaf and this forms the ground-work, and then it begins to cover itself by forming the roof of the cocoon. Subsequent proceedings, and particularly the method of formation of the bubbles, may perhaps be best described in Mr. Green's words :—

" The remarkable little cocoons . . . . . are attached to the leaves and stems of many different plants, to posts and railings or to any material that may happen to be in the neighbourhood. These white cocoons are elongate, with a median ridge or crest composed of minute glistening globules, the nature of which has hitherto puzzled me. I could never find the caterpillars that were responsible for the structures. One particular post, that was constantly ornamented with the cocoons, has been watched day and night for some time. I naturally expected to find the caterpillars making the ascent. The ground at the base of the post was scanned minutely, but no wandering caterpillars were to be found. It really seemed that, if they did not come up from below, they must come down from above. One morning after concluding my search, I instinctively glanced upwards, and there—sure enough—were several minute larvæ, hanging by long silken threads from the overspreading branches of an *Inga-saman* tree (*Pithecolobium saman*). They had let themselves down from a height of 30 or 40 feet, and were swinging in the breeze. This part of the mystery was now solved. They hung suspended until the wind drove them against something solid, and there they immediately attached themselves and constructed their cocoons. The construction of the cocoon is commenced immediately the caterpillar obtains a foothold. The position appears to be a matter of no consequence. The work is completed within two hours, which accounts for my failure to find uncovered larvæ. After weaving a thin silken covering, the creature rests for a few moments, and a convulsive movement of the posterior segments is noticeable. Very soon a globular pellet—apparently composed of dried bubbles—is voided whole. The caterpillar then turns round inside the cocoon, rapidly attaches the globule to the roof of the cocoon by a stout silken cord, bites a small hole close to the point of attachment, and pushes the globule and cord up through this aperture. The rent is then quickly repaired. This is followed by another short pause, the evacuation of a second pellet, and a repetition of the previous performance, the second pellet being placed at the opposite extremity of the cocoon, in consequence of the caterpillar having reversed its position in the cocoon. The same movements are continued, until the complete crest of

globules is in position, when the labours of the little animal are over, and it composes itself for pupation. The number of pellets probably varies, but—in one cocoon—I have counted more than forty of these little objects "(3).

These observations have been corroborated by Y. Ramachandra Rao and by Mrs. Drake, of Serampore. The former, in a note dated July 1916, wrote :—"These cocoons are remarkable owing to the fact that they are ornamented on the upper surface by a collection of numerous, bubble-like balloonets. These are prepared at the hind end of the alimentary canal of the caterpillar and ejected, whereupon the larva makes a slit on the top of the cocoon, attaches a thread to the bubble, pushes it out, and then patches up the roof. Each balloonet, when examined carefully, is found to be made up of several chambers". Mrs. Drake, in a letter dated 5th May 1914, wrote :—"The cocoons are generally made on the leaflets, and it is the making of the cocoon that is so exceedingly interesting. The caterpillar, after enclosing itself in so thin a covering that its red bands are still quite conspicuous, makes a little globule and, parting the threads at one end of its cover, thrusts out the globule. For five minutes it spins again, then turns completely round and thrusts another globule out at the other end. This it continues to do till its cocoon is covered with the glistening globules, taking five minutes for each globule and thrusting them out from alternate ends till they join in the middle of the cocoon. The way the globules come out is more like soap-bubbles than anything I can think of—indeed, I wrote my little daughter that I had found a caterpillar blowing soap-bubbles. The cocoons I have had under observation have been made in the morning and the moth has emerged in the evening of the seventh day". As the bubbles are thrust out, the cuts are closed with more silk applied from within. In this manner nearly the whole of the cocoon may be covered with these stalked bubbles. In a completed cocoon no openings can be seen and the stalks of the bubbles appear to arise from the surface of the cocoon. As regards the object of these bubbles, it has been suggested that enemies may be deluded into supposing that they are empty cocoons of parasites and that the cocoon is therefore untenanted. The larva is, however, subject to attack by Chalcidid and Braconid parasites. It may be noted that in the allied North American genus *Marmara* the exterior of the cocoon of *M. salictella* is described as "covered with little froth-like globules, which resemble minute pearls". (Clemens, *Tineina of North America*, p. 212 (1872).)

The larva pupates inside this cocoon and the moth emerges after six or seven days. The pupa is about 4 mm. long, cylindrical, and rather less than 1 mm. broad, light yellow with a greenish tinge, the eyes black and prominent

in advanced stages; the wing-cases reach to the sixth abdominal segment, the antenna-cases almost exceed the anal extremity and are a little longer than the hindleg-cases. The pupa wriggles out of the cocoon to some extent before emergence and the empty pupa-case is left protruding from the cocoon.

Although the cocoons are seen abundantly on leaves of *Casalpinia pulcherrima* and the larvæ may be found commonly in the flower-buds, the moth is less commonly seen. It sits in the characteristic Gracillariad position, with the head raised and the hinder extremity resting on the surface (Plate XXXV, fig. 2).

EPICEPHALA ALBIFRONS, STT.

Ornix ? albifrons, Stainton, T. E. S. (n.s.), V, 122 (1859)([1]).

Epicephala albifrons, Meyr., B. J., XVIII, 813 (1908)([2]); Rec. Ind. Mus., V, 227([3]).

Originally described from Calcutta, *E. albifrons* has since been recorded also from Purneah([3]), North Coorg([2]) and Travancore([3]).

This species has been bred at Pusa from larvæ found in fruits of *jar-amla* (*Phyllanthus Niruri*), and we have it also from Katihar and Bassein Fort (Bombay).

Larvæ were found at Pusa on 19th November 1911 in fruits of *Phyllanthus Niruri*, feeding on the contents of the fruits. The young larva was described as 3 mm. long, cylindrical, slightly tapering posteriorly, segments distinct, head smaller than prothorax, pale yellow; all other segments with a deep pink broad ring running all around them, the intersegmental portions pale yellow (turning light blue prior to pupation), the pink ring interrupted dorsally on prothorax and the rings on metathorax and first abdominal segment conjoined; prolegs only on third to fifth abdominal segments, besides the anal claspers. The gait of the larva is rather semi-looping. When full-grown the larva emerges from the fruit and pupates in any convenient nook in a cocoon formed under the shelter of a covering. From larvæ collected on 19th November three moths emerged between 13th and 23rd December 1911, but one larva was observed to be still resting in its cocoon on 15th January 1912 and remained in this condition until 2nd July 1912; on 1st August it was noted that the larva, which had been green until then, had turned yellow and appeared to be going to pupate and by the next day it had pupated, the moth emerging on 8th August 1912. The occurrence of this larval resting condition is noteworthy and may be compared with the long-cycle larvæ of *Platyedra gossypiella*. The pupa wriggles out of one end of the cocoon to some extent before emergence of the moth. (Pusa Insectary Cage-slip 921.)

ACROCERCOPS PENTALOCHA, MEYR.

Acrocercops pentalocha, Meyr., Gen. Ins. fasc., 128, p. 15 (1912)(1), B. J., XXIII, 112 (1914)(2).

Bred at Karwar, in North Kanara, in August from larva mining blotches in leaves of mango (*Mangifera indica*); pupa in external white flat oval cocoon (*Maxwell*)(2).

ACROCERCOPS ORDINATELLA, MEYR.

Gracilaria ordinatella, Meyr., Proc. Linn. Soc. N. S. W., V, 145 (1880)(1).

Conopomorpha ordinatella, Meyr., *l.c.*, XXXII, 54 (1907)(2).

Acrocercops ordinatella, Meyr., B. J., XVIII, 816 (1908)(3), Exot. Micr., I, 285 (1914)(4); Fletcher, Pusa Bull. 59, Note 85 (1916)(5); Meyr., Exot. Micr., I, 624-625 (1916) [redescr.](6).

Originally described from New South Wales(1), this species also occurs in Queensland(2), Ceylon(3, 4), Coorg(6), Mysore(5), Kanara(6) and apparently in Burma(5). We have it from Mysore and Virajpet (South Coorg).

It has been reared in July at Peradeniya from larva mining leaves of *Litsea* and is also a pest of camphor, mining in the leaves(5).

" Larva cylindrical, segments rather strongly marked, wholly orange, with tinge of crimson; mining blotch in upper side of leaf of *Alseodaphne semecarpifolia* (Lauraceæ) and an unidentified shrub (also recorded from *Litsea*, therefore probably feeds on several Lauraceæ); cocoon oval, orange, external, but occasionally within blotch, with two or three bubbles attached (*Maxwell*)"(6).

Meyrick(6) says that the " brilliant amber-yellow " larvæ described by Stainton under the name *quadrifasciata* [*q. v.*] " are presumably *ordinatella*."

ACROCERCOPS SUPPLEX, MEYR.

Acrocercops supplex, Meyr., Exot. Micr., II, 175 (1918)(1).

" Bred at Pusa in August from larvæ mining blotches in leaves of *Terminalia catappa* (Combretaceæ), in company with *A. erioplaca* and undistinguished from them "(1).

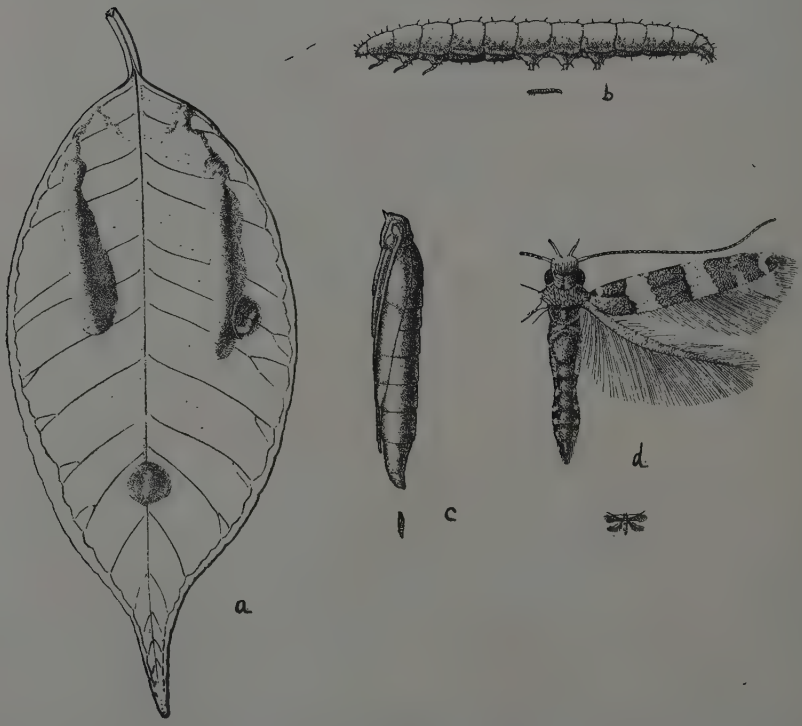
ACROCERCOPS QUADRIFASCIATA, STT.

Gracilaria quadrifasciata, Stt., T. E. S. (3), I, pt. iii, pp. 295-296, t. 10, f. 5 (1862)(1).

Acrocercops quadrifasciata, Meyr., Exot. Micr., I, 624-625 (1916)(2).

Described from Calcutta where the larvæ were found by Atkinson mining the under side of the leaves of *Urena lobata* and the upper side of the leaves of an unknown plant. Atkinson's description of these larvæ was :—

" Larva mining leaves of *Urena lobata*, 25th May 1856.—Very pale whitish-green, dorsal vessel deep green; head small; jaws light chestnut; legs



Acrocercops phaeospora:—*a*, Leaf of *Eugenia jambolana*, showing larval galleries and cocoons ; *b*, larva (x 10) ; *c*, pupa (x 10) ; *d*, moth (x 10).

concolorous with the body. The larva first detaches the lower cuticle for the full extent of the mine, and then proceeds to devour the parenchyma.

" Larva on . . . . . ?, 4th June 1856.—Of a uniform brilliant amber-yellow, transparent, smooth, with slight depressions on the sides of each segment ; jaws reddish ; the alimentary canal, when full, gives the appearance of a deep green band down the back. The larva at first mines a very irregularly-contorted gallery under the upper cuticle, and whilst engaged in this operation it only consumes the juices which unite the cuticle with the parenchyma. Gradually the greater part or the whole of the surface occupied by this gallery is mined, so as to form one chamber. The upper cuticle becomes wrinkled, and slightly contorts the leaf, so as to form a spacious apartment and the larva proceeds to devour the parenchyma. The leaf is not discoloured but appears blotched with white, from the colourless upper cuticle. When full-grown the larva quits the mine, and forms a compact orange or vermilion coloured cocoon in a depression of a leaf, or any other convenient place. After a few days the pupa thrusts one end through the cocoon, and the moth escapes "(1).

" The name [*quadrifasciata*, Stt.] must be restricted to the specimens bred from pale green larvæ mining blotches in under side of leaves of *Urena lobata* (Malvaceæ) "(2).

ACROCERCOPS PROSACTA, MEYR.

Acrocercops prosacta, Meyr., Exot. Micr., II, 175 (1918)(1).

" Bred at Pusa in August from larva mining blotch in leaf of *Ipomœa batatas* (Convolvulaceæ) "(1).

Larvæ were collected at Pusa on 26th July 1916 mining leaves of sweet-potato and the moths emerged between 4th and 6th August. No description of the early stages was made. (Ram Saran's Cage-slip, dated 26th July 1916.)

ACROCERCOPS PHÆOSPORA, MEYR. (PLATE XXXVII.)

Acrocercops phæospora, Meyr., Exot. Micr., I, 627 (1916)(1).

" Bred in August at Belgaum from larva mining a large elongate opaque much swollen blotch in leaf of *Eugenia jambolana* (*Myrtaceæ*) ; cocoon orange, external. (*Maxwell*) "(1).

Also reared at Pusa from larvæ found on 16th April 1917 mining green leaves of *Eugenia jambolana*, causing large blister-like swellings on the upper surface. There may be a single blister on either blade or two blisters on the two blades, each blister being of course caused by a single larva. The larva is small and delicate, about 3·5 mm. long, uniform pale yellow, head slightly

brownish. When full-grown the larva leaves the mine and forms a circular flat cocoon on a depressed corner (*e.g.*, by the side of a raised leaf-vein or on the upper side of the midrib) and pupates in it. The larvæ are heavily parasitized by a small black Hymenopterous fly. The moths are on the wing at Pusa throughout May. (Insectary Cage-slip 1572.)

ACROCERCOPS TERMINALIÆ, STT.

Gracilaria terminaliæ, Stainton, T. E. S. (3), I, 298-299, t. 10, f. 8 (1862)([1]). *Acrocercops terminaliæ*, Meyr., B. J., XVIII, 817 (1908)([2]).

Described from Calcutta from larvæ mining the under side of the leaves of *Terminalia Catappa*. The larva was described by Atkinson as "small, but very active. It detaches the lower cuticle over a wide extent of surface; it devours both layers of parenchyma, not continuously, but in very small oblong patches, so that the upper surface of the mined portion of the leaf which is blotched with purple, appears thickly sprinkled over with white dots. The lower cuticle, which is detached, is very thin and transparent, and, by slightly contracting, it curves the upper portion of the leaf, so as to form a very spacious vaulted chamber for the little resident. On attaining its full growth, the larva leaves the mine and spins in some convenient corner a compact white cocoon"([1]).

ACROCERCOPS CATHEDRÆA, MEYR.

Acrocercops cathedræa, Meyr., B. J., XVIII, 817 (1908)([1]), *l.c.*, XXIII, 119 (1914)([2]); Fletcher, Entl. Note 84 (1916)([3]).

Acrocercops phalarotis [nomen nudum], Lefroy, Ind. Ins. Life, p. 538 (1909)([4]).

Recorded from the Khasi Hills([1]), Pusa([3, 4]), Kanara([2]), Rajshahi([3]) and Coimbatore([3]).

Larva mining leaves of *Achyranthes aspera*([3, 4]).

Larva mining inconspicuous galleries in leaves of "*Kungina*" creeper([2]).

Larva mining leaves of mango at Pusa in August 1908. Also recorded from Rajshahi in March 1911 and Coimbatore (31st May 1913).

Larvæ were found at Pusa mining leaves of *chichira* (*Achyranthes aspera*) on 11th September 1915, as many as nine or ten larvæ in one leaf. The epidermal tissue of both surfaces is attacked and mined into large irregular patches measuring as much as 31 mm. in diameter (average about 22 mm.); the upper surface, where attacked, turns yellow and then brown and the lower surface to brownish-green.

The larva is about 3·5 mm. long and 0·75 mm. broad, yellow, segments distinct; head short with brown cheeks, clypeus and mandibles; hairs on

segments very short, arising from small shiny yellow tubercles; legs short, yellow.

When full-grown the larva quits the mine through a small hole torn in the upper epidermal layer and pupates on the green part of the upper surface of the same leaf in an oval white cocoon about 4 by 2 mm., constructed inside an outer fine irregular brownish covering, measuring about 5 by 2·5 mm. and usually placed in a slightly curved portion of the leaf. (Umrao Bahadur's Cage-slip 66.)

Larvæ were also found at Pusa on 12th September 1916, mining leaves of *Achyranthes aspera* and from these a moth emerged on 22nd September. (Insectary Cage-slip 1492.)

ACROCERCOPS ORTHOSTACTA, MEYR.

Acrocercops orthostacta, Meyr., Exot. Micr., II, 174 (1918)(1).

" Bred at Pusa in August from larvæ mining blotches in leaves of *Sida cordifolia* (Malvaceæ) "(1).

Larvæ were collected mining *bariar* leaves at Pusa on 28th July 1916 and the moths emerged between 4th and 10th August. No description of the early stages was made. (Ram Saran's Cage-slip, dated 28th July 1916.)

Also reared in April 1918 from larvæ mining leaves of *Sida spinosa*.

ACROCERCOPS AUSTEROPA, MEYR.

Acrocercops austeropa, Meyr., B. J., XXIII, 121-122 (1914)(1).

Described from North Kanara(1).

Larva on " Akri " ; cocoon very flat, attached to surface of leaf, whitish ochreous, with four scattered bubbles on its surface, apparently similar to those on the cocoon of *Epicephala chalybacma*(1).

This species has been reared at Pusa from larvæ mining leaves of *Bauhinia purpurea* and *B. variegata*.

ACROCERCOPS RESPLENDENS, STT.

Gracilaria resplendens, Stainton, T. E. S. (3), I, 294-295, t. 10, f. 4 (1862)(1).
Acrocercops resplendens, Meyr., B. J., XVIII, 818 (1908)(2), Wytsm. Gen. Ins., fasc. 128, p. 16, tab., ff. 20 *a-c* (1912)(3).

Originally described from Calcutta(1) and since recorded from the Khasi Hills(2). Common at Pusa, perhaps attached to *Ficus religiosa*, but not yet bred. We have specimens from Pusa, Chapra, Puri and the Khasi Hills.

ACROCERCOPS TRICYMA, MEYR.

Acrocercops tricyma, Meyr., B. J., XVIII, 819-820 (1908)(1).

Described from the Khasi Hills(1) and Pusa(1).

Bred at Pusa in April from larvæ mining leaves of *Blumea lacera*(1).

Larvæ were found at Pusa on 22nd April 1907 mining leaves of *kukraunda* * (*Blumea lacera*), four or five larvæ sometimes found in a single mine. The larva was described as 3 mm. long, rather flattened anteriorly, tapering posteriorly, yellowish-green, head flattened, yellow. Pupation occurred within the mine in a cocoon of very white silk. Pupa 3-5 mm. long, yellow, slender. Moths emerged between 28th April and 5th May. (A. Mujtaba's Cage-slip 21.)

ACROCERCOPS ÆMULA, MEYR.

Acrocercops æmula, Meyr., Exot. Micr., I, 628 (1916)(1).

Bred at Pusa in February from larvæ mining leaves of *Cynoglossum* (*Boraginaceæ*) (Fletcher)(1). We have it also from Virajpet (South Coorg) and Abbottabad (larva mining *Cynoglossum* leaves).

Larvæ were found at Pusa on 6th February 1914 and 16th December 1915, mining in leaves of *kukraunda* (*Cynoglossum* sp.). As many as four or five larvæ may be present in a single leaf mining in the epidermal layers of the upper surface and feeding on the chlorophyll, the tunnels being situated in the middle of the leaves and not necessarily on the edges only. The larval excrement is deposited in one place within the mine and not in a line, and the mine is not linear but long and broad, although irregular in shape. If the upper epidermis is removed the larva is able to spin another thin webbing over it. The larva is yellow and about 6 mm. long by 0·7 mm. broad; the head is the most highly chitinized portion and is dark brown, mandibles black, antennæ three-jointed, third joint rather pointed and longer than the other two together; legs blackish; three pairs of prolegs and anal claspers; each segment with a single small lateral hair situated near the spiracle; dorsal area smooth, without hairs; nine spiracles, each slightly protruded above the body-surface and tinged with brown.

When full-fed the larva pupates in a silken web spun below the part mined and immediately below the upper whitened epidermis. The moulted skin is attached to the anal end of the pupa within the flattish cocoon. The pupa is about 5 mm. long, yellowish-white, ventral surface flattened, dorsal surface smooth and cylindrical, head portion broadest and abruptly terminated in a point, each segment with very minute single dorsal hairs, segments distinct. From larvæ collected on 6th February 1914 the moths emerged between 16th and 20th February, and from mined leaves collected on 16th December 1915

* Under *A. æmula* the name of *kukraundu* is given as *Cynoglossum* sp. In the case of some of these old records it is impossible to check these identifications, but *A. æmula* has also been reared from *Blumea balsamifera*.

the moths emerged between 23rd December and 3rd January. 1916. The larva is parasitized by a yellow Braconid. (Dwarka Prasad Singh's Cage-slip No. 1 and C. S. Misra's Cage-slip of 16th December 1915.)

This species has also been reared at Pusa from larvæ collected on 21st December 1916 and found mining just under the epidermal layer on the upper surface of leaves of *Blumea balsamifera*. The mine was in the form of a blister extending on both sides of the midrib. These larvæ pupated in cocoons formed within the mine and the moths emerged between 2nd and 11th January 1917. (Pusa Insectary Cage-slip 1506.)

ACROCERCOPS ISONOMA, MEYR.

Acrocercops isonoma, Meyr., Exot. Micr., I, 625 (1916)(1); Fletcher, Entl. Note 84 (1916)(2).

Bred at Pusa in May from larva mining in leaf of *Mangifera indica* (1, 2).

ACROCERCOPS ISODELTA, MEYR.

Acrocercops isodelta, Meyr., B. J., XVIII, 820 (1908)(1), *l.c.*, XXIII, 119 (1914)(2).

Recorded from Maskeliya, in Ceylon(1), and from Karwar, in North Kanara(2).

Larva mining blotches in leaves of *Colebrookea oppositifolia* (Labiatæ)(2).

ACROCERCOPS GEMONIELLA, STT.

Gracilaria gemoniella, Stainton, T. E. S. (3) I, 297, t. 10, f. 6 (1862)(1).

Acrocercops gemoniella, Meyr., B. J., XXIII, 120 (1914)(2), Exot. Micr., I, 628 (1916)(3).

Originally described from Calcutta(1), this species has been bred at Karwar, in North Kanara, from larvæ mining blotches in leaves of sugarcane (*Saccharum officinarum*); pupa in external oval brownish-yellow cocoon in depression on surface of leaf (*Maxwell*)(2).

"Bred from green larvæ mining large blotches in leaf of *Semecarpus Anacardium* (Anacardiaceæ), several larvæ in one blotch; cocoon external, cream-coloured. (*Maxwell.*) The same species was previously sent by Mr. Maxwell as bred from sugarcane, but it would seem probable that there must have been some error in that record"(3).

This species was bred at Pusa in January 1915 from a larva mining a leaf of *Achras sapota*.

ACROCERCOPS BARRINGTONIELLA, DEV.

Gracilaria barringtoniella, van Deventer, Tijds. voor Ent., XLVII, 14-17, t. 1, ff. 5, 5[a], 5[b] (1908)([1]).

Acrocercops barringtoniella, Meyr., B. J., XXIII, 121 (1914)([2]).

Originally described from Java([1]). Within our limits recorded from North Kanara([2]).

Larva mines in young leaves of *Barringtonia spicata*([1]) and also mines blotches in leaves of *Careya arborea* (*Lecythidaceæ*)([2]).

ACROCERCOPS LYSIBATHRA, MEYR.

Acrocercops lysibathra, Meyr., Exot. Micr., I, 626-627 (1916)([1]).

Originally described from Pusa, this species has been bred at Pusa from a larva mining "*bhagandhra*" leaf. (A. Mujtaba's Cage-slip 24.)

It has also been reared from larvæ collected at Pusa on 17th March 1916 mining leaves of *lasora* (*Cordia latifolia*). The larva eats the upper epidermal tissue, the veins of the leaf being left untouched, and forms an irregular blister-like mine white around the margins and brown in the centre, as many as four larvæ being present in a single leaf. The larva was described as 5 mm. long and about 1 mm. broad, slightly flattened, segments distinct, yellow with a greenish middorsal stripe on abdominal segments; head small, flattened, brown; thoracic segments broadest, prothorax brownish; legs short, yellow; only four pairs of prolegs, concolorous with the body. Pupation takes place outside of the mine. The moth is on the wing from March to May. (Ram Saran's Cage-slip, dated 17th March 1916.)

ACROCERCOPS PHRACTOPA, MEYR.

Acrocercops phractopa, Meyr., Exot. Micr., II, 177 (1918)([1]).

"Bred at Pusa in April from larvæ mining blotches in leaves of ***Ficus infectoria***"([1]).

ACROCERCOPS GEOMETRA, MEYR.

Acrocercops geometra, Meyr., Exot. Micr., I, 626 (1916)([1]).

Described from Pusa and Coimbatore([1]).

Larva mining blotch in leaf of *Cordia myxa* (*Boraginaceæ*) (Fletcher)([1]). This species was also bred at Coimbatore from larvæ mining *Cordia* leaves.

Larvæ were found at Pusa on 11th July 1908, and were described as about 5 mm. long, flattened, tapering posteriorly, red, head very small and armed with a flat yellow cap, prothorax yellowish-red, legs creamy, prolegs red. The larva mines in the leaves of the foodplant and pupates externally

Fig. 1. *Acrocercops hierocosma*:—*a*, mined litchi leaf (natural size), showing larval gallery and cocoon; *b*, larva (x 10); *c*, pupa (x 10); *d*, moth (x 10).

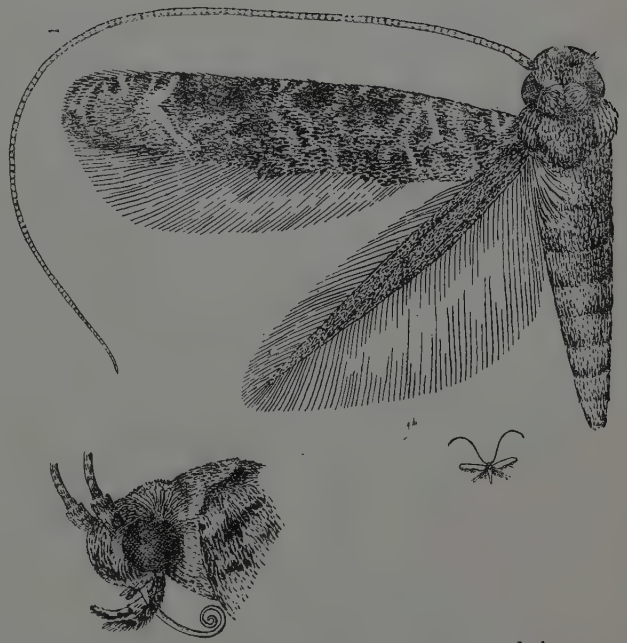


Fig. 2. *Acrocercops auricilla*:—Moth, natural size and magnified.
Below is seen a side-view of head of moth, more highly magnified.

in a double-walled cocoon. Pupa rather less than 4 mm. long, brown, wings dark-brown; pupal period five days. (A. Mujtaba's Cage-slip 43.)

ACROCERCOPS HYPHANTICA, MEYR.

Acrocercops hyphantica, Meyr., Exot. Micr., I, 25 (1912)(1).

Described from specimens reared at Pusa(1).

Larva flattened, slightly tapering posteriorly, yellowish-green, head whitish-yellow; mining leaves of *Cæsalpinia bonducella* (*Leguminosæ*); pupa in a cocoon outside the mine(1).

Pupa about 4 mm. long, head and anal segment yellow, wings yellowish-green, remainder green. Pupal period four or five days. Pupa emerges half way out of the cocoon. (A. Mujtaba's Cage-slip 56.)

ACROCERCOPS HIEROCOSMA, MEYR. (PLATE XXXVIII, FIG. 1.)

Acrocercops hierocosma, Meyr., Wytsm. Gen. Ins., fasc. 128, p. 18 (1912)(1); Fletcher, Entl. Note 86 (1916)(2), Ann. Rept. Impl. Entom., 1917-18, p. 104 (1918)(3).

Originally described from North Australia, this species has been reared at Pusa from a larva mining leaves of *Nephelium litchi*(2). In August 1917 quite appreciable damage was done at Pusa to the tender leaves of *Nephelium litchi* by the mining of this larva(3).

The larva first of all bores into the midrib which develops a dusky red colour; it begins somewhere near the base of the leaf and works towards the apex. As it goes forward it mines the blade of the leaf on both sides of the midrib, along the veins, producing a characteristic palmate dusky-red mine, as the entire mined portion develops a dusky-red colour. In bad cases of attack the whole leaf dries up.

The full-grown larva is about 5 mm. long and about 0·75 mm. across the anterior part of the body which tapers slightly posteriorly, segments distinct, uniform green, fourth pair of prolegs absent.

When full-fed, the larva leaves the mine and forms a round scale-like flat cocoon on the leaf or stem wherever a suitable cover or concavity is available. In confinement cocoons were formed in the corners of the cage or by the side of the protuberant midrib of the leaf. The cocoon is almost transparent, so that the contained pupa is partly visible.

The pupa is slender, cylindrical, about 4·3 mm. from head to anal extremity, beyond which the extremity of the leg-case extends for another 1·5 mm. and about 0·75 mm. broad, frons with a curved spine with which the pupa pierces the cocoon; colour green at first, afterwards turning yellow-brown.

On emergence, the pupa protrudes from the cocoon to some extent. Pupal period about seven days. (Insectary Cage-slips 1299, 1653.)

The moths are found at Pusa from August to October.

ACROCERCOPS AURICILLA, STAINT. (PLATE XXXVIII, FIG. 2.)

Gracilaria ? auricilla, Stt., T. E. S. (2), V, 120-121 (1859)(1).
Acrocercops cramerella (*nec* Snell.), Meyr., Exot. Micr., II, 4 (1916)(2).

Described originally from "near Calcutta"(1). "Reared at Belgachia, Bengal, in September from larvæ mining in leaves of mahogany, *Swietenia* (Meliaceæ)"(2). We have it also from Pusa.

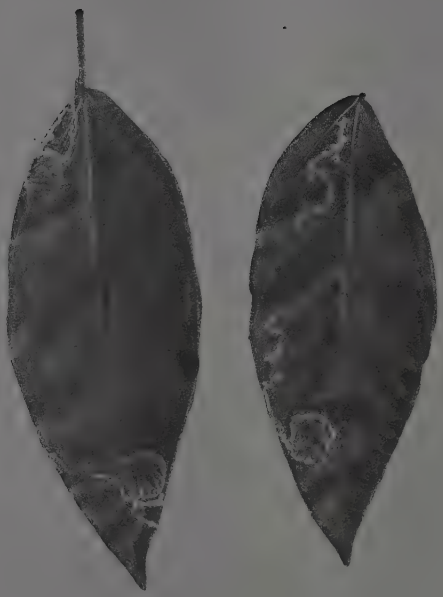
Specimens of affected mahogany leaves were received in the beginning of September 1915 from the Principal of the Veterinary College, Belgachia, who stated that the leaves were mined and that the trees looked in bad condition as a consequence. The leaves were tunnelled on both surfaces by mines which at first are long and narrow (not exceeding 0·5 mm.) and irregular but which expand into oval whitish blotches, averaging about 11 by 7 mm. When the leaf is mined at its edges the mined portion becomes papery, turns deep brick-red, and withers. The edges of the outer cover are thickened until there is made an elongate space sufficient to contain the pupa. In some cases the whitish blotches containing the pupæ touch or coalesce with one another.

The pupa is about 7 mm. long and 1 mm. broad; head brown with a ventral triangular structure with dentate sides, eye-cap large, antenna-case brownish-yellow, reaching to first abdominal segment and spotted irregularly with black; first pair of legs short, reaching to end of thoracic region; second pair of legs reaching to anal extremity; third pair of legs projecting 1·5 mm. beyond anal extremity; thoracic region dorsally with short brown hairs arising from small rounded raised tubercles; thoracic segments yellowish-brown; abdominal segments pale, tinged with green and with short brown hairs on small rounded raised tubercles, spiracles distinct and appear like rounded brown holes at the anterior end of each segment.

ACROCERCOPS TELESTIS, MEYR.

Acrocercops telestis, Meyr., E. M. M., XLVII, 213 (Sept. 1911)(1); Lefroy, Ind. Ins. Life, p. 538 (1909)(2); Fletcher, Entl. Note 87 (1916)(3).

Described from specimens reared at Pusa from larvæ mining leaves of *Trewia nudiflora* (Euphorbiaceæ)(1,2). Also reared at Coimbatore in February 1913 from larvæ on *Trewia*, and at Pusa in August 1907 from *Gmelina arborea*



Leaves of *Ficus glomerata* mined by *Acrocercops desiccata.*

and in September 1913 from leaves of *Eugenia jambolana*(3). We also have this species from Moulmein.

Larvæ were found at Pusa on 24th July 1907 mining leaves of *pitha* (*Trewia nudiflora*). The larva was described as 3 mm. long, rather flattened, tapering posteriorly, yellow, head pale; afterwards 4·5 mm. long, green; only four pairs of prolegs. Pupated externally on upper or underside of leaves or in corners of the cage, cocoon of very fine white silken threads. Pupa 4 mm. long, green, last two abdominal segments yellowish. Pupa protrudes about half its length from cocoon on emergence of moth; pupal period about five days. (A. Majtaba's Cage-slip 25.)

Larvæ were also collected at Pusa mining leaves of *Eugenia jambolana* on 1st September 1913 and from these leaves moths emerged from 6th to 9th September. The larval mine forms a prominent blister-like blotch, inside which the larva moves freely about between the epidermal layers, filling the space with excrement. When removed from the mine the larva is unable to enter another leaf unless the epidermis is opened up artificially. (Dwarka Prasad Singh's Cage-slip, dated 1st September 1913.)

ACROCERCOPS DESICCATA, MEYR. (PLATE XXXIX.)

Acrocercops desiccata, Meyr., Exot. Micr., II, 4 (1916)(1).

Described from Peradeniya and Pusa. At Pusa it was bred from larvæ mining blotches in leaves of *Ficus glomerata*(1).

The larva mines just below the epidermis on the upper surface of the leaf. The mine commences as a zigzag white line, quite prominent on the green leaf, and develops suddenly into a blotch. The full-grown larva is about 3·5 mm. long, flattened, gradually tapering posteriorly, segments distinct, three pairs of thoracic legs and five [?] pairs of prolegs functional although small; colour light green when young, changing to golden-yellow and ultimately to reddish before pupation. When full-fed the larva almost always leaves the mine and pupates elsewhere in a flattish cocoon formed of well-woven silk and having a very thin almost transparent parchment-like appearance. Each cocoon is double, there being a small inner case inside a larger outer case. The cocoon is usually constructed in a corner or small concavity. Before emergence of the moth, the pupa wriggles out of the cocoon for about half its length, the empty pupa-case being left protruding from the cocoon. Larvæ were collected in *Ficus glomerata* leaves on 23rd December 1914; one formed a cocoon on 24th December and emerged on 20th January and another pupated on 5th January and emerged on 24th January 1915. (Pusa Insectary Cage-slip 1148.)

ACROCERCOPS USTULATELLA, STT.

Gracilaria ? ustulatella, Stainton, T. E. S. (n.s.), V, 121-122 (1859)(1).
Conopomorpha isochorda, Meyr., B. J., XVII, 746 (1907)(2).
Acrocercops ustulatella, Meyr., B. J., XVIII, 825 (1908)(3).

Originally described from Calcutta(1). Also recorded from Peradeniya(2). Larva mines in young leaves of ebony(2).

ACROCERCOPS SYNGRAMMA, MEYR. (PLATE XL, FIG. 1.)

Acrocercops syngramma, Meyr., B. J., XXIII, 120 (1914)(1); Fletcher, Entl. Note 84 (1916)(2).

Described from Karwar in North Kanara(1), where it was bred in July from larva mining a compact blotch in leaves of mango (*Mangifera indica*); pupa in a detached oval brownish-yellow cocoon on surface of leaf (*Maxwell*)(1).

Reared at Pusa in September 1907 and again in August 1908 from larvæ mining mango leaves. Also taken at Bankipur in October 1911(2). We have it also from Pusa in September to November 1916, from Saidapet in January 1907 and from Coimbatore in December 1914 and March 1915, in all cases reared from larvæ mining mango leaves.

The larva mines under the epidermis on the upper surface of tender mango leaves, causing large round or roundish blisters which are greyish-white in colour. The larva is about 5 mm. long and about 0·7 mm. across the thoracic region, cylindrical (or almost so), tapering posteriorly, segments well-defined and rather prominent laterally, pale greenish-yellow, the dark contents of alimentary canal partially visible through the body; head brownish-yellow, shiny, smaller than prothorax, which has a faint shiny yellowish shield; a faint whitish tracheal line along the spiracular region; primary hairs short; legs and prolegs concolorous with body; prolegs on third, fourth, fifth abdominal and on anal segment. From leaves collected on 25th September moths emerged from 4th October to 1st December 1916, and from leaves collected on 2nd November 1916 moths emerged on 15th and 16th November. (Insectary Cage-slip 1478 and Ram Saran's Cage-slip, dated 2nd November 1916.)

ACROCERCOPS LABYRINTHICA, MEYR.

Acrocercops labyrinthica, Meyr., Exot. Micr., II, 177-178 (1918)(1).

"Bred at Pusa in March and April from larvæ mining blotches in leaves of *Trema* sp. (Urticaceæ)"(1).

Larvæ were collected at Pusa on 16th March 1916 mining the upper surface of leaves of *Trema* sp. The larva was described as 5 mm. long by

Fig. 1. *Acrocercops syngramma*:—Moth, magnified (x 16). Below is seen a side-view of head of moth, more highly magnified.

Fig. 2. *Liocrobyla parachista*:—Moth, magnified (x 30). Below is seen a side-view of the head, more highly magnified.

1 mm. broad, flattened, dark green, yellowish laterally, segments distinct; head small, brown; thoracic segments broadest; prothoracic shield represented by two blackish dots; only four pairs of prolegs. Pupation occurs outside of the mine, in a white cocoon usually on the upper surface of the leaf near the midrib. The moth is on the wing in March and April and probably later. (Dwarka Prasad Singh's Cage-slip, dated 16th March 1916, and Ram Saran's Cage-slip, dated 3rd April 1916.)

ACROCERCOPS ALLACTOPA, MEYR.

Acrocercops allactopa, Meyr., Exot. Micr., I, 627 (1916)(1).

Bred at Karwar, in North Kanara, in July and August from larvæ mining swollen blotches in leaves of *Eugenia jambolana* (*Myrtaceæ*), several larvæ in one blotch; cocoon external (*Maxwell*)(1).

ACROCERCOPS BIFRENIS, MEYR.

Acrocercops bifrenis, Meyr., Exot. Micr., II, 176 (1918)(1).

"Bred at Khanapur, Belgaum, from larvæ mining numerous blotches in leaves of two unidentified plants, January, February. Larva when young light red, tapering posteriorly, when full-grown bright crimson and cylindrical; blotch irregular, often confluent, each with an irregular roundish rent in the cuticle whilst still occupied by the larva; pupa outside the mine, in an oval orange cocoon; imago quivers on its legs like *vanula* (*Maxwell*). Closely allied to *vanula*; as that species feeds on *Terminalia* (Combretaceæ), it is not improbable that the foodplants of this are of the same order."(1).

ACROCERCOPS BROCHOGRAMMA, MEYR.

Acrocercops brochogramma, Meyr., Exot. Micr., I, 285 (1914)(1).

Described from Peradeniya, where it was bred in June from leaves of *Hibiscus* sp. containing galls of a Phytoptid(1).

ACROCERCOPS CRYSTALLOPA, MEYR.

Acrocercops crystallopa, Meyr., Exot. Micr., I, 627-628 (1916)(1).

Bred at Karwar, in North Kanara, in July and August from larvæ mining somewhat circular blotches in leaves of *Memecylon amplexicaule* (*Melastomaceæ*), larva cylindrical with lateral prominences, emitting single rather long hairs; pupa internal in blotch, without cocoon (*Maxwell*)(1).

ACROCERCOPS CYLICOTA, MEYR.

Acrocercops cylicota, Meyr., B. J., XXIII, 119 (1914)(1).

Described from Karwar in North Kanara(1).

Larva mining blotches in leaves of *Colebrookea oppositifolia* (*Labiatæ*); pupa in cocoon in folded edge of leaf (*Maxwell*)(1).

ACROCERCOPS DIATONICA, MEYR.

Acrocercops diatonica, Meyr., Exot. Micr., I, 625-626 (1916)(1).

" Bred at Shirve, in North Kanara, in December from larvæ mining light blister-like blotches on upper side of leaves of an unidentified plant, occupying whole leaf; cocoon yellowish, within mine (*Maxwell*) "(1).

ACROCERCOPS ELAPHOPA, MEYR.

Acrocercops elaphopa, Meyr., B. J., XXIII, 121 (1914)(1).

Reared at Karwar, in North Kanara, in July from external cocoon on depressed vein of surface of leaf of " Total " creeper(1).

ACROCERCOPS ERIOPLACA, MEYR.

Acrocercops erioplaca, Meyr., Exot. Micr., II, 175 (1918)(1).

" Bred at Pusa in August from larvæ mining blotches in leaves of *Terminalia catappa* (Combretaceæ) "(1).

ACROCERCOPS EXTENUATA, MEYR.

Acrocercops extenuata, Meyr., Exot. Micr., I, 624 (1916)(1).

" Bred at Karwar, in North Kanara, in July from larvæ mining blotches on under surface of leaves of unidentified shrub, several blotches in a leaf separated by main veins (*Maxwell*) "(1).

ACROCERCOPS HEMIGLYPTA, MEYR.

Acrocercops hemiglypta, Meyr., Exot. Micr., II, 1 (1916)(1).

Described from Karwar, in North Kanara, where it was " bred in August from larvæ mining round blotches in leaves of an unidentified plant, cocoon external, white (*Maxwell*) "(1).

ACROCERCOPS LOXIAS, MEYR.

Acrocercops loxias, Meyr., Exot. Micr., II, 174 (1918)(1).

" Bred at Jodhpur, Rajputana, in June from *Eugenia jambolana* (Myrtaceæ), (*Beeson*) "(1).

ACROCERCOPS MACROCLINA, MEYR.

Acrocercops macroclina, Meyr., Exot. Micr., II, 2 (1916)(1).

Described from Karwar, in North Kanara, where it was " bred in August from larvæ mining blotches on upper side of leaves of *Wagatea spicata* (*Leguminosæ*), occupying whole leaf; cocoon external, white (*Maxwell*) "(1).

ACROCERCOPS PHAROPEDA, MEYR.

Acrocercops pharopeda, Meyr., Exot. Micr., I, 626 (1916)(1).

" Bred at Karwar, in North Kanara, in July from larva mining small semi-transparent blotch in leaf of unidentified creeper; cocoon brownish-yellow, detached (*Maxwell*) "(1).

ACROCERCOPS SCANDALOTA, MEYR.

Acrocercops scandalota, Meyr., B. J., XXIII, 120 (1914)(1), Exot. Micr., I, 628 (1916)(2).

Described from North Coorg(1).

" Bred in North Kanara from larva mining blotch in leaf of *Helicteres isora* (Sterculiaceæ) (*Maxwell*) "(2).

ACROCERCOPS SCENIAS, MEYR.

Acrocercops scenias, Meyr., B. J., XXIII, 122 (1914)(1).

Described from Karwar, in North Kanara(1), where it was bred in June from a bright green larva mining galleries in leaves of " *Changana* " bush, many larvæ in each leaf; pupa long, green, in oval white transparent cocoon on depressed vein of leaf (*Maxwell*)"(1).

ACROCERCOPS SCRIPTULATA, MEYR.

Acrocercops scriptulata, Meyr., Exot. Micr., II, 2-3 (1916)(1).

Described from Karwar in North Kanara, where it was " bred in July from unusually large irregularly elongate oval semi-transparent white cocoons, with three or four small attached bubbles, found on surface of leaf, each on a vein, scattered about on various sorts of bushes in neighbourhood of *Terminalia paniculata* (Combretaceæ), which is probably the foodplant; at considerable distances apart, indicating a wandering habit before pupating (*Maxwell*)"(1).

ACROCERCOPS TENERA, MEYR.

Acrocercops tenera, Meyr., Exot. Micr., I, 284-285 (1914)(1).

Bred at Peradeniya from larva mining leaves of *Schleichera trijuga* "(1).

ACROCERCOPS TRISCALMA, MEYR.

Acrocercops triscalma, Meyr., Exot. Micr., II, 1 (1916)(1).

Described from Karwar, in North Kanara, where it was " bred in August and September from larvæ mining blotches on upper side of leaves of *Wagatea spicata* (Leguminosæ), occupying whole leaf; cocoon external, white (*Maxwell*) "(1).

ACROCERCOPS VANULA, MEYR.

Acrocercops vanula, Meyr., Wytsm. Gen. Ins. fasc., 128, p. 17 (1912)(1), B. J., XXIII, 121 (1914)(2).

Described from Karwar, in North Kanara(1).

"Larva mining large blotches in leaves of *Terminalia tomentosa* (Combretaceæ); pupa yellowish, in large oval cream-coloured cocoon spun usually on vein inside the mine, the cuticle subsequently peeling off and leaving the cocoon exposed; this seems the normal arrangement, but in captivity the larva sometimes makes an external cocoon in a recess on surface of leaf (*Maxwell*)"(2). Mr. Maxwell (*in litt.*) gives the name of the foodplant as *T. paniculata*.

LIOCROBYLA PARASCHISTA, MEYR. (PLATE XL, FIG. 2.)

Liocrobyla paraschista, Meyr., Exot. Micr., II, 5 (Oct. 1916)(1).

Parectopa labrodes, Meyr. MS. (*ined.*)

Reared at Manchikeri, North Kanara, "in May from larvæ mining in leaves of *Butea frondosa* (Leguminosæ) (*Maxwell*), and at Pusa in February from larvæ mining in leaves of *Cajanus indicus* (*Fletcher*); it may therefore probably feed in some other Leguminosæ. Larva mines a blotch beneath upper cuticle of leaf, building up two heaps of excrement, between which the larva rests in a covered passage leading obliquely to under side of leaf, where a small open door exists in a dry opaque patch; cocoon external, oval (*Maxwell*)"(1).

This species has been reared at Pusa on several occasions from larvæ mining leaves of *Cajanus indicus* in April, September, October and December, and from leaves of *Desmodium gangeticum* in January and July.

The larva mines just under the epidermal layer of either surface, but in the case of *Cajanus* usually the upper surface of the leaf, producing an extremely irregular brown patch measuring about one square inch in total area. (Plate XLI.) In the case of mines in *Desmodium* leaves the greater portion of the mine is not visible from the opposite side of the leaf; a small portion only, where the mesophyll tissue also has been eaten, is visible from the opposite surface as a dry brown patch. The larva thrusts its anal extremity through a hole in the lower surface of the mine to eject its frass and the gallery is therefore kept clean. The larva is green, broadest across the thoracic portion, tapering posteriorly, segments distinct; head long, brown; only four pairs of prolegs. The larva leaves the mine before pupation and forms a white cocoon, about 6 mm. long, on the surface of the leaf in any convenient corner, often alongside a midrib on the upper surface of a leaf.

Leaves of *Cajanus indicus* mined by *Liocrobyla parachista*

PLATE XLI.

Leaves of *Dolichos lablab* mined by *Cyphosticha coerulea.*

PLATE XLII.

The dark-brown pupa protrudes from the cocoon on emergence of the moth. (Insectary Cage-slip 1430 and Umrao Bahadur's Cage-slip 112.)

STOMPHASTIS PLECTICA, MEYR.

Stomphastis plectica, Meyr., Wytsm. Gen. Ins. fasc., 128, p. 19, tab., ff. 1, 26 (1912)(1), B. J., XXIII, 122 (1914)(2).

Originally described from Karwar, in North Kanara(1). Also recorded from South Africa(2). We have it from Bankura, Pusa and Surandi (Tinnevelly District).

"Larva mining blotches in leaves of *Sebastiana chamælea* (Euphorbiaceæ); pupa in detached oval white cocoon in depression on top of leaf, preferring the extreme tip (*Maxwell*)"(2). Mr. Maxwell (*in litt.*) describes the larva as stout, tapering posteriorly; head small, fuscous, body green.

This species has been reared from larvæ found at Bankura on 16th July 1917, mining leaves of *Jatropha gossypifolia* (Euphorbiaceæ), one or several larvæ being found in one leaf, and at Pusa from larvæ mining "*bhagendra*" leaf. Larva pale greenish-yellow, head brown, no prolegs on sixth abdominal segment. When full-grown it leaves the mine and forms a flattened whitish papery silken cocoon on any depression on the leaf or in any suitable corner. The pupa wriggles out of the cocoon on emergence of the moth. (Insectary Cage-slip 1609.)

The Tinnevelly specimens are labelled "from wild castor leaves"; presumably *Jatropha* is intended.

PARECTOPA COCCINEA, WLSM.

Gracilaria coccinea, Wlsm., in Swinh. Cat. Het. Oxf. Mus., II, 576 (1900)(1). *Macarostola coccinea*, Meyr., B. J., XVIII, 827 (1908)(2).

Described from Ootacamund where the larva is a leaf-roller on myrtle(1).

CYPHOSTICHA CŒRULEA, MEYR.

Cyphosticha cærulea, Meyr., Exot. Micr., I, 26 (1912)(1); Proc. Second Entl. Meeting, pp. 42, 56 (1917)(2).

Described from Pusa(1), but probably widely distributed in the Plains as we have it from Coimbatore also.

"Larva somewhat flattened, slightly tapering posteriorly, greenish, laterally pale yellow, with subdorsal reddish dot on each segment, head flat; when full-grown, becomes wholly blood-red: mining a whitish elongate blotch in leaves of *Crotalaria juncea* (Leguminosæ) or a brownish blotch in leaves of *Vigna sinensis* (Leguminosæ)"(1).

Occurs commonly at Pusa and Coimbatore, mining in leaves of *Cajanus indicus*(2) and *Dolichos lablab*(2).

This species has been found at Pusa on numerous occasions, mining the leaves of *Dolichos lablab*, *Vicia faba*, *Phaseolus mungo*, and *Vigna catjang* from April to October. The larva mines the upper surface of the leaf, feeding just below the epidermal layer which turns brown or brownish-white. The mine starts as a narrow irregular line but later on widens into a broad blotch which shows up prominently on the leaf. (Plate XLII.) The larva is about 4 or 5 mm. long, rather flattened, segments sharply defined and slightly protruding laterally, tapering posteriorly from thoracic region, uniform reddish-brown, the green contents of the alimentary canal visible along the length of the body, and with a red submedian stripe ; head flattened, smaller than prothorax, light brown ; legs and prolegs well developed, reddish-brown ; prolegs only on third to fifth abdominal segments, together with the anal claspers. When full-fed, the larva emerges from the mine and pupates in a white silken cocoon afforded by the folding of any portion or by the side of a protruding leaf-vein. The pupa wriggles out through one end of the cocoon before the moth emerges and the empty pupa-case is left protruding from the cocoon. The pupa is about 3·5 mm. long, pale yellow, eyes red, wings and last two abdominal segments whitish-yellow. (Insectary Cage-slip 903, Dwarka Prasad Singh's Cage-slips, dated 9th May 1914 and 16th April 1916, and Ram Saran's Cage slips, dated 17th and 25th April 1916.)

GRACILLARIA ACIDULA, MEYR. (PLATE XLIII.)

Acrocercops acidula, Meyr., E. M. M., XLVII, 213 (Sept. 1911)(1).

Gracilaria acidula, Meyr., Exot. Micr., I, 26 (1912)(2), *id.*, *l.c.*, II, 178 (1912)(3).

Described from Pusa(1). Larva on *Albizzia stipulata* (Leguminosæ)(1).

" Mr. Fletcher informs me that the larva mines leaves of *Phyllanthus emblica* (Euphorbiaceæ), not of *Albizzia* as originally stated through a mistaken identification of a native name "(3).

This species is abundant at Pusa, the larvæ mining in the leaflets of compound leaves of *amlak* (*Phyllanthus emblica*). The larva mines a part or a whole of a leaflet, usually on the under surface but also on the upper surface of the leaf, which turns pale brown or deep brown where mined. The mine usually commences near the apex of a leaflet as a narrow sinuous line which expands into an elongate blotch towards the base of the leaflet. (Plate XLIII, fig. 7.) The upper epidermis is completely separated from the lower, the intervening space being filled with blackish pellets of excrement. The

EXPLANATION OF PLATE XLIII.

OPHIOLARIA ACIDULA.

Fig. 1. Moth, resting attitude, from side, natural size and magnified (× 16).
" 2. Pupa, natural size and magnified (× 16).
" 3. Twig of Phyllanthus emblica showing larval mines in leaflets and how the leaflets are twisted up to form cocoons (natural size).
" 4. A twisted leaflet forming a cocoon, magnified (× 10).
" 5. Full-fed larva, natural size and magnified (× 16).
" 6. Moth, wings expanded, natural size and magnified (× 13).

This species has been found at Pusa on numerous occasions, mining

EXPLANATION OF PLATE XLIII.

GRACILLARIA ACIDULA.

Fig. 1. Moth, resting attitude, from side, natural size and magnified (× 16).
„ 2. Pupa, natural size and magnified (× 16).
„ 3. Twig of *Phyllanthus emblica* showing larval mines in leaflets and how the leaflets are twisted up to form cocoons (natural size).
„ 4. A twisted leaflet forming a cocoon, magnified (× 10).
„ 5. Full-fed larva, natural size and magnified (× 16).
„ 6. Moth, wings expanded, natural size and magnified (× 13).

(GRACILLARIA ACIDULA, MEYR. PLATE XLIII.)

acidula, Meyr., E. M. M., [illegible]).

Gracilaria acidula, Meyr., Exot. [illegible]). *Id. l.c.*, II. 178 [illegible]).

[illegible] Larva [illegible] *Phaseolus semierectus* (Leguminosæ). [illegible] *Phyllanthus* [illegible] a narrow mine [illegible].

This species is abundant at Pusa, the [illegible] compound leaves of *amlak* (*Phyllanthus emblica*) [illegible] brown or dirty [illegible] mine [illegible] The [illegible]

GRACILLARIA ACIDULA.

Fig. 1. Details of larva of *Gracillaria acidula*:—*a*, Head, from above, magnified (x 67) ; *b*, head, from below, magnified (x 67) ; *c*, antenna, highly magnified (x 333) ; *d*, mesothoracic leg, right side, magnified (x 67).

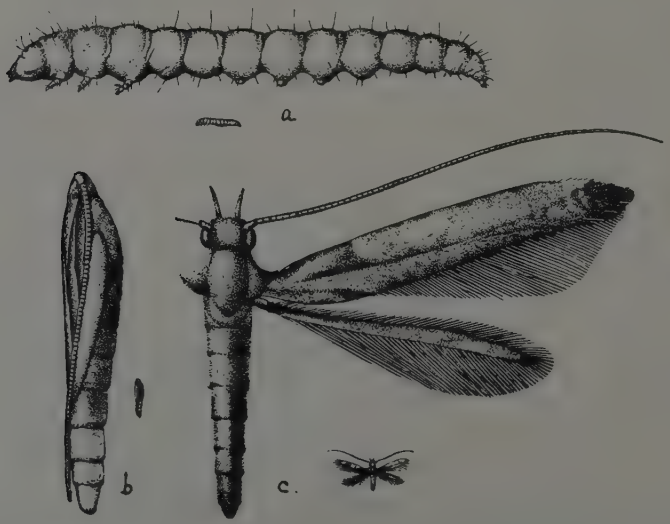


Fig. 2. *Gracillaria zachrysa*:—*a*, Larva, natural size and magnified (x 11) (from a spirit specimen) ; *b*, pupa ; *c*, moth, natural size and magnified (x 11).

larvæ are able to leave their mines freely and, if a branch is disturbed, almost all the larvæ leave their mines and walk about.

The larva is about 3 mm. long, cylindrical, very slightly tapering posteriorly, segments distinct, yellow, with thin scattered hairs; head rounded, yellow; prolegs only on third to fifth abdominal segments, together with the anal claspers. (Plate XLIII, fig. 5.)

When full-fed the larva leaves the mine through a round hole bitten through the upper epidermis and twists another green leaflet into a cone to form a pupal chamber. It first of all turns up the tip of the leaflet and fixes its apex to one side of the upper surface of the leaf with silken threads; it then bites three or four small holes near the edge of the leaflet near the rolled-up apex and a few more holes about one millimeter nearer the base and proceeds gradually to bend and twist the leaflet until the whole of it is rolled-up into a cone. (Plate XLIII, fig. 4.) Many of these cones may be formed close together and look like a row of small fruits hanging from the rachis. (Plate XLIII, fig. 3.) Inside the cone a thin white silken cocoon is formed and inside this the larva pupates.

The pupa is about 2·5 to 3 mm. long, cylindrical, yellow. (Plate XLIII, fig. 2.) In some examples the antenna-case projects beyond the anal extremity, in others it barely projects. The pupa wriggles out of the cocoon to some extent before the moth emerges.

The moth rests in the usual Gracillariad manner and waves its antennæ about briskly. (Plate XLIII, fig. 1.) It occurs at Pusa from March to June and probably throughout the year.

GRACILLARIA OCTOPUNCTATA, TURNER.

Gracilaria octopunctata, Turner, Tr. Roy. Soc. S. Austral., 1894, 123(1); Meyr., Pr. Linn. Soc. N. S. W., 1907, 65(2), B. J., XVIII, 828 (1908)(3), Rec. Ind. Mus., V, 227(4), Tr. N. Z. Inst., 1909, 73(5), *l.c.*, XLVII, 228 (1915)(6); Lefroy, Ind. Ins. Life, p. 538 (1909)(7).

Originally described from Australia, where it is recorded from Queensland(2, 6). Also known to occur in the Kermadec Islands(5, 6) and in Africa(6). Within our limits it has been recorded from Pusa(3), the Khasi Hills(3), Darjiling(4), and North Coorg(3). We have it from Pusa, Lebong (Darjiling), and Bassein Fort (Bombay).

The larva rolls the small leaves of *Dalbergia sissu*, forming a small mass of often dry leaves in which it lives and pupates. The pupa is sometimes in a web of very white glistening silk on a leaflet(7).

At Pusa it has been reared from a pupa found on *Polygonum* [? accidental pupation-place] and from larvæ found on 14th August 1906 rolling leaves of *Dalbergia sissu* (Leguminosæ). Sometimes several leaves are joined together and these masses of leaves are found to be dry and rotten. The larva was described as 6 mm. long, flattened, very slightly tapering posteriorly, yellowish-green ; head pale, prothorax with many small black spots. Pupation takes place in a rolled leaf, the pupa being 5·5 mm. long, brown. The pupal period is about six days. (A. Mujtaba's Cage-slip 8.)

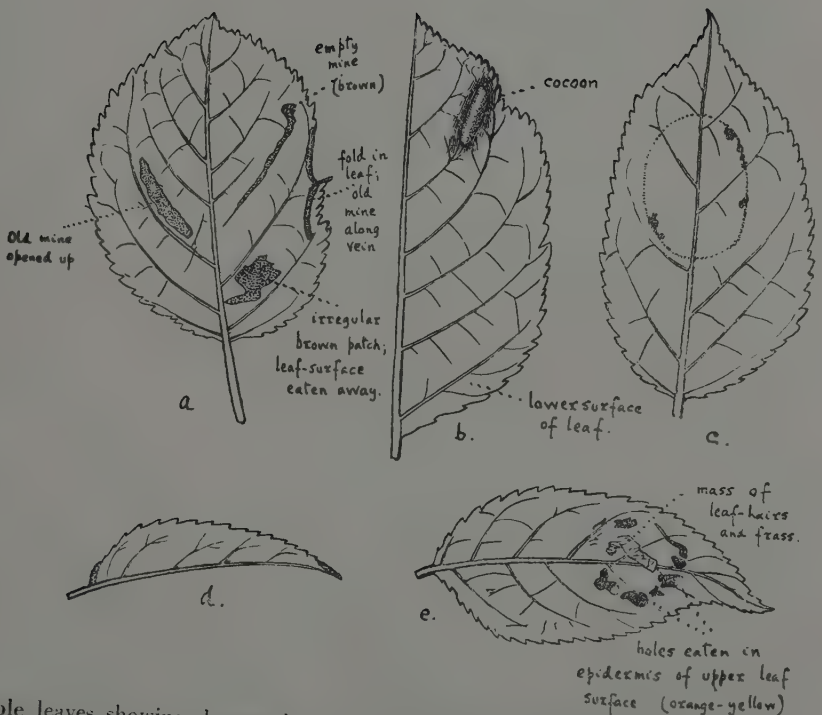
GRACILLARIA ZACHRYSA, MEYR. (PLATE XLIV, FIG. 2.)

Gracilaria zachrysa, Meyr., B. J., XVII, 983 (1907)(1), *l.c.*, XVIII, 829 (1908)(2), Wytsm., Gen. Ins. fasc., 128, p. 29, tab., f. 4 (1912)(3) ; Meyr., Exot. Micr., II, 179 (1918)(4) ; [*nec* Busck, *Insec. Inscit. Menstr.*, III, 42-43 (1915)= *azaleella*, Brants].

Originally described from Maskeliya in Ceylon(1). " Recently bred in India from larvæ making cones on leaves of apple (*Pyrus malus*) (*Fletcher*). Hence I was led to discover that *azaleella*, Brants (=*azaleæ*, Busck), bred from *Azalea indica* imported from Japan into Europe and North America, and probably a native of Japan, is really quite distinct from *zachrysa*, and I was mistaken in asserting the contrary "(4).

This species probably occurs throughout the apple-growing districts of Northern India, the larva feeding on young leaves of apple and being at times a considerable pest. We have it from Parachinar, Peshawar and Abbottabad and from Shillong, and I have seen attacked apple-leaves at Ramgarh (Kumaon).

In its early stages the larva mines the leaf, but later on it leaves the mine and folds, or more rarely rolls, a young leaf. The attack is first noticeable as a rusty-yellow irregular blotch on the under side of a leaf. The enclosed larva is not visible on holding the leaf up to the light but on opening up the blotch it is found as a pale greenish-yellow or greenish-white larva with very strongly-defined segments, tapering anally. The larva mines on the lower surface of the leaf, often several in one leaf, sometimes as many as four or five. The gallery proceeds along and parallel with the interior (*i.e.*, nearest to the midrib) side of a vein, apparently starting at the inner end and working outwards. When fresh, the mine is green and inconspicuous, slightly shiny like a snail-track ; it is filled with leaf-hairs and usually contains frass at the outer end. Later on, the larva bites a hole through the upper surface of the mine and leaves it. Apparently after the larva has left (? due to growth of the leaf) the mine usually forms a puckered fold in the leaf-surface. At one



Apple leaves showing damage by larva of *Gracillaria zachrysa*:—*a*. leaf showing mines, fold, and patch eaten. *b*, Lower surface of leaf showing cocoon. *c*, older leaf with young larva. Leaf opened out. The portion sewn together (upper surface) marked with dotted line. Portions of epidermis of leaf nibbled by larva (whitish), marked in black. *d*, Young leaf. Edges sewn together longitudinally. *e*. Half-grown leaf containing larva, completely folded along edges, opened up, showing method of feeding of larva.

end of the mine the upper surface of the leaf turns rusty-yellow; otherwise the mine is only visible from above by the fold in the leaf. Sometimes, when near the edge of a leaf, the edge is folded over to form a sort of trough in which the mine lies; it is not possible to say whether this is done deliberately by the larva or whether it is caused by the natural growth of the leaf. After leaving the mine, the larva ties up a young leaf longitudinally, the edges of the leaf being joined together over the upper surface on which the larva feeds in its bag-like shelter, nibbling patches out of the epidermis of the leaf, the attacked portions turning rust-coloured. The leaf-hairs are detached and piled in a mass which is often mingled with frass to form a long roll and this is characteristic of the attack even when the leaf contains no larva, which is apparently often eaten by spiders and birds. More rarely, the larva makes a shelter by turning over a portion of the edge of a leaf. The adult larva is unicolorous, pale green or yellowish-green, segments less distinct than in the younger (mining) stage and it does not taper anally so perceptibly.

The larva leaves the leaf to pupate in an elongate-oval cocoon of white silk in which the pupa is dimly visible. In captivity the cocoon is spun in any convenient angle and under natural conditions it has been found on the lower surface of a leaf, where it was placed in a slight fold formed by drawing the leaf together to form a trough, the edges of the trough being kept in place by white cross-threads.

GRACILLARIA THEIVORA, WLSM.

Gracilaria theivora, Wlsm., Ind. Mus. Notes, II, 49 (1891)(1); Watt and Mann, Tea Pests, pp. 228-232, ff. 23-25 (1903)(2); Meyr., B. J., XVIII, 829 (1908)(3); Lefroy, Ind. Ins. Life, p. 538 (1909)(4).

Described from Pundaluoya in Ceylon(1), where it has also been found at Madulsima(3) and Maskeliya(3). Lefroy(4) states that it occurs in India also. Watt and Mann also record it from Assam, Darjiling and the Kangra Valley(2) and we have it from Lebong and Margherita.

The larva feeds upon tea (*Camellia theifera*).

"The egg is deposited near the midrib and on the under surface of the leaf. On hatching, the minute caterpillar is at first a leaf-miner. It eats along, in a somewhat tortuous course, towards the margin. It then escapes and then becomes a leaf-roller, and subsequently causes the margin of the leaf, for half an inch to an inch in length and perhaps less than one-eighth of an inch in breadth, to turn over itself. Within that enclosure it commences to eat the epidermis of the enclosed portion. Shortly after, however, it migrates to a fresh leaf and now commences its more vigorous action. The

overturned margin dies, and gives to the leaf a withered, discoloured and torn appearance. . . . . The insect in fact, during its larval existence, repeatedly changes its house and thus destroys a large number of leaves " . . . . . Larva minute, yellowish-white, about 13 mm. long, with prolegs only on third to fifth abdominal segments, with the anal claspers. The larva carefully sews " up the leaf as it rolls it round and when the conch-shell-like structure, thus formed, has been completely wound up and firmly bound together at both ends, the caterpillar proceeds to eat the leaf from the tip downwards. As it progresses, the excretory matter is carefully packed on one side, and partitioned off by a fold of the margin of the leaf brought down for that purpose. When the contained portions of the leaf have been devoured, the operation of winding up the leaf still further is renewed. Coil after coil is made, but usually not more than half the leaf is eaten. The insect then migrates and commences once more to roll a leaf around itself ". " When mature, the caterpillar spins a small silken cocoon about one-quarter of an inch long and little more than one-sixteenth in breadth. This will be found within depressions of the leaf or under the lee of a midrib. It opens by a circular mouth to allow of the escape of the perfect insect "(2). [This last point would seem to require verification.]

GRACILLARIA SOYELLA, DEV.

Gracilaria soyella, van Deventer, Tijds. voor Ent., XLVII, 22-25, t. 2, ff. 1, 1*a* (1904)(1).

Gracilaria acrotherma, Meyr., B. J., XVIII, 830 (1908)(2).

Gracilaria soyella, Fletcher, Entl. Note 88 (1916)(3); Proc. Second Entl. Meeting, p. 42 (1917)(4).

Originally described from Java(1), this species has also been recorded from Colombo(2) and Hakgala(2), in Ceylon. It is probably common throughout the Plains of India, as it occurs freely at Pusa(3) and Coimbatore(3) on *Cajanus indicus*(4) and has also been reared at Pusa from *Phaseolus mungo*.

Larva in leaves of *Soya hispida* in Java(1), on *Cajanus indicus* and *Atylosia candollei* in Ceylon(2). It is said to mine the leaves of *Cajanus indicus* in Ceylon(2), but this is probably an error, as in India the larva has been noted on this plant both at Pusa and Coimbatore and found to roll up the tip of the leaf, each end of the chamber so formed being fastened down with silk. The larva turns over the apex of the leaf, usually on to the under surface, and fastens it down with silk and doubles and redoubles the fold until it has made a shelter within which it lives and feeds on the epidermis of the leaf, the interior of the cone being filled with excrement. The larva is about 6 mm.

long, slender, cylindrical, uniformly pale yellow in colour, with only four pairs of prolegs. Many larvæ are parasitized by a small Chalcidid. Pupation may take place within the cone or outside of it in any suitable depression on a leaf, within a yellowish-white silken cocoon to which the pupa is attached by four processes on the anal end of the pupa. Pupa about 5 mm. long and about 1 mm. broad across thoracic region, each segment furnished dorsally with two transverse rows, on anterior and posterior margins, of spinous hairs, those of anterior row thicker and more distinct; similar rows of hairs are present also on the ventral surface but are much fainter. The pupal period is about eight days in February and six or seven days in June. This seems to occur throughout the year at Pusa on *Cajanus indicus* and *Phaseolus mungo*. (Pusa Insectary Cage-slips 646 and 1409.)

GRACILLARIA ISELÆA, MEYR.

Gracilaria iselæa, Meyr., Exot. Micr., I, 286 (1914)(1).

Described from Peradeniya, where it was bred in April from larvæ on *Spondias mangiferæ*(1).

GRACILLARIA ? ? COFFEIFOLIELLA, NIETN.

Gracilaria coffeifoliella, Nietner, Obs. on Enemies of Coffee-tree in Ceylon, p. 24 (1861)(1); *l.c.*, p. 16 (1880)(2); Moore, Lep. Ceylon, III, 525 (1887)(3); Koningsberger, Med. Plant. Java, XLIV, 2 (1901)(4); Meyr., B. J., XVIII, 832 (1908)(5).

Originally described from Ceylon(1); also recorded from Java(4).

Larva said to be common as a leaf-miner in coffee, but the identity of the species concerned is very doubtful(5).

Mines are commonly found in coffee leaves in all the coffee-growing districts in Southern India, but I have never been able to breed any moths out of them, and most of those examined have contained Dipterous larvæ.